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ABSTRACT
Minicourse 1, an auto-instructional package based on the microteaching-video tape recorder process, instructs the teacher in specific teaching skills and directs him in self-evaluation of his own teaching. Field tests of Minicourse (MC) 1 (questioning skill at the elementary school level) indicated behaviorally significant changes in teachers and led to the development of four additional models designed to test the generalizability of the minicourse principle to other teaching skills. Other minicourses developed were MC 2, teaching the kindergarten child with minimal language experience; MC 3, questioning in a high school class discussion; MC 5, tutoring in elementary school mathematics; and MC 8, organizing the kindergarten for independent learning and small group instruction. Preliminary field tests, comparing pre- and postcourse behavior, indicate all of the courses yielded significant teacher change and succeeded in providing teachers with a generalized approach for systematically dealing with problem areas. For example, MC 2 helped teachers to solve language problems systematically which previously were ignored or handled ineffectually; MC 3 increased pupil talk and decreased teacher talk in class discussions through judicious use of questioning techniques; MC 5 and MC 8 helped teachers to apply a systematic rather than hit-or-miss approach in structuring different types of learning situations. A description of the five models (skills taught and test data) is attached. (ED 024 647 and ED 024 650 are related documents.) (JS)

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THE RANGE OF TEACHING SKILLS THAT CAN BE CHANGED BY THE MINICOURSE MODEL

By Philip Langer
Development Team Director

A paper presented as part of the symposium:
"MICROTEACHING IN TEACHER EDUCATION--NEW DIRECTION

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The range of teaching skills that can be changed by the minicourse model

Philip Langer
Development Team Director

At this stage of the symposium I can presume that everyone here has gotten at least one impression--that microteaching, using a videotape recorder, appears to have some value in changing teacher behavior under certain conditions. The qualification is critical since the most probable behavior among educators is to seize upon each new idea and innovation in education as a panacea for all educational ills. One has only to note the disemboweled corpse of classroom television, for example, to get the point. This was an interesting approach, never really developed, misused continuously, and just generally done in by incredibly bad research and development. Counterparts in psychology today include group dynamics, cognitive dissonance, and possibly sensitivity training.

The Far West Laboratory for Educational Research and Development, one of a number of regional laboratories established under Title 4, decided to follow up the microteaching procedures developed at Stanford University (Allen & Fortune, 1966). As developed at Stanford and elsewhere, microteaching involves the teacher or teacher intern practicing one or more skills in a scaled down lesson (approximately 10 to 15 minutes), with any where from 5 to 10 pupils. The lesson is videotaped and critiqued. Generally, the lesson is retaught and critiqued a second time. The results obtained at Stanford and elsewhere indicate that teacher intern gains are at least equal to those achieved through traditional student teaching, and are accomplished in considerably less time (Kallenbach and Romanda, 1966).

The Far West Laboratory decided on the development of an auto-instructional package which we based around the microteaching-video tape recorder process. This self-contained package , both instructs the teacher with regard to specific teaching skills and directs him in self-evaluations of his own microteaching. All of the activities and materials are carefully developed and organized through a testing cycle which extends over a year.(1) I should think a more detailed explanation on the minicourse is in order before we get to the data.

The basic unit in each minicourse is the instructional sequence. Usually there are three to four in each minicourse. For illustrative purposes I will talk about a modal instructional sequence, although significant variations have been developed. To repeat, the instructional sequence is the teaching unit in the minicourse. Each instructional sequence is built around one to three related teaching skills which are defined in behavioral terms. Normally the instructional sequence requires an hour per day for 3 days.

On the first day the teacher views carefully detailed film materials which define, illustrate, and model the teaching skills. In addition, the teacher is provided with supportive materials in a handbook. These are concepts more appropriate to the written page rather than the film medium. After reading about and viewing the specific skills, the teacher then prepares a 10 to 15 minute lesson to be microtaught the next day with 5 to 10 pupils.

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1. A detailed analysis of the Minicourse model is available elsewhere (Langer, in press).

On the second day of the instructional sequence the teacher micro-teaches this brief lesson, practicing the skills that he has learned about on the previous day. This lesson is simultaneously videotaped and subsequently critiqued by the teacher. Unlike the Stanford Model, no supervisors are present during the critiquing session. The teacher uses highly objective self-evaluation forms which allow the teacher to categorize and interpret his behavior. He then revises the lesson on the basis of his own critical analysis.

On the third day of the instructional sequence he reteaches the lesson and again analyzes his performance. In effect, the three day instructional cycle consists of learn,, microteach, and reteach. Throughout the course the teacher follows a detailed schedule of activities.

After the course has been developed and produced, it undergoes a preliminary field test. This is a small sample, tightly controlled field operation. It is designed to answer the question, "Does the course work?" If our data is affirmative, the course is revised and then we move on to the next testing operation. This is the main field test, which is a large scale testing operation with N's anywhere from 40-70, carried out at various locales. Let me emphasize at this point that the data presented today is Main Field test data.

The Main Field test supplies us with a generalization gradient. That is, teachers with varied backgrounds, using different kinds of subject content, with different types of students, produce a range of results. In short, the generalizability of the minicourse across varied classrooms.

Measures of the course effectiveness are usually obtained for the Main Field test from pre- and post-course tapes of teacher classroom behavior.

After all, we want to know at which level the teacher is operating in his classroom before the course begins, and how this performance is modified by the minicourse. The tapes, I might add, are critiqued by highly trained outside observers (usually California Berkeley students) using a double-blind technique.

So much for the preparatory remarks. In the Fall of 1967 we field tested Minicourse 1. The Main field test procedures were as follows:

(1) Forty-eight elementary school teachers at 12 school sites in California and Nevada participated;

(2) Twenty minute videotape samples were made of a classroom discussion before and after the course;

(3) These tapes were analyzed using a double-blind approach.

If you will turn now to your handouts, you will note that they are color coded.* In addition, the first page for each minicourse lists the skills by instructional sequence, while the other pages are devoted to data analysis. Minicourse 1 is on the white sheets.

Again the first page of the Minicourse 1 section lists the specific skills in Minicourse 1 by Instructional Sequence. Thus, for Instructional Sequence 1 the specific behaviors covered are pausing, dealing with incorrect responses, and calling on both volunteers and non-volunteers. You can read the others at your leisure. On the next page of the handout you will find a summary of the data analysis. Minicourse 1 has been discussed elsewhere (Borg, et. al., 1968) and we just want to point out some of our original findings with respect to the first minicourse.

* For purposes of reproduction on microfiche and hard copy, the pages have been labelled with the name of the appropriate color.

First of all, we have tried to distinguish between behavioral and statistical significance. These are not mutually inclusive categories. We define a behavioral change as one of sufficient magnitude to make a noticable difference in the behavior of participants in the teaching situation. For example, item number 2, redirection, occurred on the average 27 times in the pre-tape, and 41 times in the post-tape. This 50% increase represents to us behavioral as well as statistical significance. Length of pupil pause (#9), on the other hand, is statistically significant, but hardly behavioral. However, most of the changes were behaviorally significant. I might add that these changes were virtually undiminished when we again recorded the teachers' behavior four months later (Borg, 1969).

The results from Minicourse 1 were quite encouraging, but unfortunately we could not follow the Washington dictum that "When you have seen one Minicourse you have seen them all". In short, we were not ready for production à la Detroit. Instead we proceded to develop four other minicourses, which we will discuss today. The skills chosen for each of these courses were designed to test the generalizability of the minicourse model rather than any particular system of teaching skills. To be perfectly honest, the skills selected were also a function of the "state of the art" as we knew it. I might add, parenthetically, that we are now developing a system of minicourse skills.

And finally, some general cautions to be observed before moving on to the specific courses. This summer we have analyzed hundreds of hours of tapes. The results given are preliminary in nature. Moreoever, we

do not have time to explain the rationale for each course. All we can do is draw some tentative conclusions regarding the minicourse model after a very brief overview.

Elated by our success with Minicourse 1 which dealt with questioning at the elementary level, we decided to produce a minicourse on questioning aimed at the secondary school level. However, the courses differed markedly not only in terms of the grade level, but in emphasis.

If you will turn to the first page of the blue section of your handout you will note that unlike Minicourse 1, Minicourse 3 emphasized the use of higher cognitive questions as opposed to general discussion skills. The questions were broken down more specifically into categories of comprehension, analysis, and evaluation. (See Instructional Sequences, 3, 4, and 5.) As a personal note I might add that I headed the development team for Minicourse 3.

I should add a point here to be kept in mind when we turn to the data. Along with encouragement in the use of higher cognitive questions, the course also emphasized better student answers. In short, it was simply not a question of more analysis questions per se, but analysis questions and answers. This emphasis, as we shall point out, produced some rather interesting results.

In January of 1969, 74 teachers participated in the Main Field test of Minicourse 3. Thirteen minute pre-post tape samples were made of class discussions. Compared to the elementary school sample in Minicourse 1, the high school group was quite heterogeneous. Participating schools included both public and parochial; subject matter ranged from religion to

business math, and in a number of instances the students participating in the pre-tape differed from those in the post-tape. In addition, teachers received a very detailed preparation sheet for the pre-tape observation period. This sheet not only listed all of the skills we were concerned with in the course, but defined each of them very carefully.

Let's now turn to the Minicourse 3 data sheet which is the next page. First of all, we are reporting Wilcoxon T's for matched pairs. Distributions were quite skewed and we chose to use a non-parametic analysis. In addition to giving the pre- and post-medians, we have also given the frequencies for increases (designated by +), decreases (by -), and no change (o). I might add that just about all the minicourse results which follow were analyzed in a similar manner.

On the data sheet for Minicourse 3 you will notice that the sheet is divided by a double line. The items above represent specific teacher behavior, while the items below represent corrollary data which helps our analysis.

As you may recall we asked for a 13 minute discussion lesson. This put pressure on the teachers, and resulted in some strategy decisions. If you will look at item number 7, the percentage of higher cognitive questions, you will find that there was a jump of almost 20 percentage points. However when we break this change down to the use of the specific question types, we observe that the difference could be attributed to a 50% decrease in the number of fact questions. The number of comprehension, analysis, and evaluation questions remained about the same. All of this,

of course, is reflected in the number of changes....positive, negative, and no change at all.

It is obvious that we will have to break down the results further by content areas, since these question types are sensitive to content. However, what apparently happened was that the teachers were not simply asking more higher cognitive questions, but were trying to get better student responses.

If you will look below the double line you will find, for example, that (1) the average length of student response significantly increased, (2) the total number of student responses decreased, (3) the percentage of student talk increased, and (4) the percentage of teacher talk decreased. All of these represent behavioral rather than statistical changes.

One explanation was that instead of simply asking more higher cognitive questions, teachers sought better pupil answers. You can examine the other results at your leisure.

The next minicourse differed markedly from Minicourses 1 and 3. This course, Minicourse 8, was designed to enable kindergarten teachers to organize their classrooms for independent pupil activities so that they could work with small groups. Forty-six kindergarten teachers participated in the study which took place in the Spring of 1969. Unlike our previous minicourses, pre- and post-course evaluations were made by pairs of trained observers in the classroom. These observers categorized teacher and pupil behavior during a 40 minute lesson in which the teacher organized her classroom for independent activity. Dr. Marjorie Kelley and Miss Betty Ward were in charge of development.

If you will turn to the first sheet of the yellow section in the handout, you will find the skills within each instructional sequence. If you scan the behaviors you will note that they are basically sequential. The teacher starts off by explaining what she is trying to do and ends with follow-up activities for students who complete their task. Also, and this is critical, the course emphasized pupil self-reliance.

The next page compares the pre- and post-course evaluation of teacher behavior. A very interesting finding was the absence of any real semblance of organization by the teacher prior to the course. The post-course data indicates teacher changes were <u>all</u> in the direction of systematic application of skills. Keeping in mind that while many of the changes are not large in absolute terms, they all represent substantial proportional changes. This pattern has also been noted in other minicourses where we were dealing with low frequency behavior. Needless to say the ratio of sign changes (i.e., T) are very significant.

As we noted earlier, pupil self-reliance was also emphasized in Minicourse 8. At the same time the teachers were observed, student behavior was also recorded. On the next page you will find the student analogs for teacher behavior. For example, the teacher behavior described as "Discuss working alone with pupil" (#1 on the preceeding page) has as its student counterpart "Child gives examples of working alone." The numbers in the two tables correspond to each other. There is strong evidence of systematic changes in pupil behavior corresponding to teacher changes. The rank order correlation (rho) between post-course teacher behavior and post-course student behavior is .74. Teachers apparently communicated

quite effectively to the students just what was needed in terms of pupil behavior. In short, teachers and pupils learned together.

A third course, Minicourse 5, dealt with individual tutoring in mathematics. Dr. Meredith Gall is director of the team that carried out the development of this minicourse. As in Minicourse 8, the course concerns itself with a systematic approach to a process usually not handled with any high degree of organization. That is, for most teachers, tutoring is a hit and miss affair. When we get to the data we shall see that this statement is not without justification.

Minicourse 5 was produced and tested in the Spring of 1969. Forty-four elementary school teachers participated in the main field test. Pre- and post-course evaluations were made on the basis of two 10-minute math tutoring sessions. In the first tutoring session the teacher was asked to tutor a student in an example involving a number operation. She could use up to 10 minutes. After this tutoring sequence, the teacher engaged in another tutoring session with a second student on a verbal reasoning problem. Again, the teacher had up to 10 minutes to complete the task.

If you will turn now to the green section of the handout, on the first page you will find the skills within each instructional sequence for Minicourse 5. Again, the aim of the course is to train the teacher to precede through a carefully detailed sequence of procedures. Number operations and verbal problems were dealt with separately.

On the next page you will find some preliminary analyses of teacher changes as a function of Minicourse 5. In terms of the total number of

diagnostic questions there was a substantial increase in the number of questions. Breaking down the questions into sub-categories we must remember our previous warning about low frequency behaviors. The most striking evidence of changes can be found in the number of sign changes. This, of course, is reflected in the T's. Without exception, the changes were in the predicted direction.

Another way to analyze the data is through time measures. The time spent using demonstration techniques shows very marked increases in the predicted direction. As added evidence of the minicourse effectiveness all but two of the teachers had previously gone through in-service math courses emphasizing the demonstration techniques listed here. And yet, their pre-course tapes showed practically no evidence of learning. However, at the end of Minicourse 5, teachers were displaying demonstration skills at a highly significant level.

The fourth course I would like to report is Minicourse 2, which concerns itself with language development of children coming from minimal language backgrounds. This minicourse was developed under the direction of Dr. Marjorie L. Kelley. It is extremely difficult to present any overview of a language development course, because of the obvious complexities of the course structure. If you will turn now to the first page of the orange section of the handout, you will see the kinds of skills stressed in Minicourse 2. To emphasize a point made earlier, the course dealt with the language development for children from minimal language backgrounds.

Fifty-one kindergarten teachers in various parts of the country participated in the main field test of Minicourse 2. Evaluation of Minicourse 2 was based on the following: participating teachers taught four distinct 10-minute lessons emphasizing skills on each of the four instructional sequences. These four 10-minute lessons were carried out before and after the course.

Since our analysis of the teacher behavior required a very elaborate category system, we can only present a few examples of teacher behavior coded. This will give you some idea of what took place, without overwhelming you. If you will turn to the next page, the data sheet marked Minicourse 2, Instructional Sequence 1, you will find a sample of the skills dealt with in Instructional Sequence 1. Here again we find some significant shifts in teacher behavior. The most marked increase was in teaching concepts related to positional words. The second data sheet deals with the second instructional sequence. Here the evidence is even more striking with respect to changes in teacher behavior. Considering the wide range of teaching skills covered in Minicourse 2, the teacher changes appear significant from a developmental point of view.

Adding it all up, what does it mean? Although the results cover a wide range of courses, it would appear that all the courses have succeeded in providing teachers with a generalized approach for systematically coping with problem areas. Thus, Minicourse 3 succeeded in increasing pupil talk and decreasing teacher talk in class discussions through a judicious use of questions and questioning techniques. Minicourses 5 and 8 results clearly indicated that teachers had developed a rationale for handling

learning situations which were basically disorganized hit and miss affairs prior to the course. Minicourse 2 succeeded in getting teachers to systematically solve language problems that had either been ignored or handled ineffectually prior to that time. Putting it another way, teachers now knew what they had to do and how to do it.

Failure of some specific skills within each minicourse (at least in terms of the significance of the data) can be attributed to several factors:

(1) Technically we either did a poor job of defining the skill and/or exemplifying precisely when the teacher should use it, or

(2) During the evaluation phase the occasion did not arise for the use of the skill.

Both of these factors will be considered in revising the minicourses. However, to repeat a point first made, the preponderance of evidence is that most teachers changed significantly as a result of the minicourse.

The next question is why? We have discussed this issue at length elsewhere (Langer, in press), but basically it involves having the teacher analyze her own behavior as a basis for change. We have established through the minicourse model a learning environment conducive to behavioral change.

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White

Minicourse 1

Effective Questioning in a Classroom Discussion

Instructional Sequence 1

Objective: To change teacher behaviors that will increase the pupil's readiness to respond to discussion questions.

Teacher Behaviors: Ask question, pause 5 seconds, then call on pupil.
Deal with incorrect answers in an accepting, nonpunitive manner.
Call on both volunteers and non-volunteers in order to keep all pupils alert and distribute participation.

Instructional Sequence 2

Objective: To change teacher behavior so as to decrease teacher participation and raise the level of pupil response.

Teacher Behaviors: Redirection--directing the same question to several pupils.
Framing questions that call for longer pupil responses.
a. Ask for sets or groups of information when framing information level questions.
b. Avoid yes-no replies.
Framing questions that require the pupil to use higher cognitive processes.

Instructional Sequence 3

Objective: To increase the teacher's use of probing behaviors in order to guide the pupil to more complete and thoughtful responses.

Teacher Behaviors: Prompting
Seeking further clarification and pupil insight--this is a combination of two probing behaviors treated separately in the preliminary field test form of the course. Seeking further clarification and seeking to increase pupil awareness differ largely in terms of the quality of the pupil's initial reply.
Refocusing the pupil's response.

Instructional Sequence 4

Objective: To reduce teacher behaviors that interfere with the flow of the discussion

Teacher Behaviors: Teacher should not repeat her questions.
Teacher should not answer her own questions.
Teacher should not repeat pupil answers.

White

Minicourse 1

MAIN FIELD TEST DATA

	Behavior Compared	Pre Tape Mean	Post Tape Mean	t	Sig. Level
1.	Percentage of discussion time taken by teacher talk.	51.64	27.75	8.95	.001
2.	Number of times teacher used redirection.	26.69	40.92	4.98	.001
3.	Number of times teacher used prompting.	4.10	7.17	3.28	.001
4.	Number of times teacher used further clarification.	4.17	6.73	3.01	.005
5.	Number of times teacher used refocusing.	.10	.02	.00	NS
6.	Number of times teacher repeated his/her own questions.	13.68	4.68	7.26	.001
7.	Number of times teacher repeated pupil answers.	30.68	4.36	11.47	.001
8.	Number of times teacher answered his/her own questions.	4.62	.72	6.88	.001
9.	Length of pupil responses in words (based on 5 minute samples of pre and post tapes).	5.63	11.78	5.91*	.001
10.	Number of 1-word pupil responses (based on 5 minute samples of pre and post tapes).	5.82	2.57	3.61*	.001
11.	Length of teacher's pause after question (based on 5 minute samples of pre and post tapes).	1.93	2.32	1.90	.05
12.	Frequency of punitive teacher reactions to incorrect pupil answers	.12	.10	.00	NS
13.	Percentage of total questions that called for higher cognitive pupil responses.	37.30	52.00	2.94	.005

* Means would have been approximately 4 times larger if entire tapes had been analyzed, t-test would have been higher.

Blue

Minicourse 3

Effective Questioning in a High School Class Discussion

Practice Lesson

Objective: To acquire familiarity with minicourse procedures.
To distribute student participation evenly.

Teacher Behaviors: Call on non-volunteers as well as volunteers.
Redirection--directing the same question to several pupils.

Instructional Sequence 1

Objective: To reduce teacher behaviors that interfere with class discussion.

Teacher Behaviors: Repeating own questions--the teacher asks a question, and then repeats the question before calling on a student.
Answering own questions--the teacher asks a question, and then immediately proceeds to answer it.
Repeating student's answer--the teacher repeats the student's answer.

Instructional Sequence 2

Objective: To probe for more thoughful responses from students.

Teacher Behaviors: Prompting--involve simple, specific questions or hints which help the student gradually to a satisfactory answer.
Seeking further clarification--to help the student arrive at a more satisfactory response if his answer was unclear or incomplete.

Instructional Sequence 3

Objective: To increase teachers' use of higher cognitive questions.

Teacher Behaviors: Frame comprehension questions--these ask students to demonstrate understanding of information rather than simply to recite facts.
Use prompting, further clarification, and redirection.

Instructional Sequence 4

Objective: To increase teachers' use of higher cognitive questions.
To elicit thoughtful responses to these questions.

Blue

Teacher Behaviors: Frame analysis questions--these stimulate students to analyze information to discover hidden meanings by detecting assumptions, implications, logical fallacies, etc.
Use prompting, further clarification, and redirection.

Instructional Sequence 5

Objectives: To increase teachers' use of higher cognitive questions.
To elicit thoughtful responses to these questions.

Teacher Behaviors: Frame evaluation questions--questions which require students to make judgments, form opinions or give personal reactions to information.
Use prompting, further clarification, and redirection.

Minicourse 3

MAIN FIELD TEST DATA

Behavior Compared	Median Pre (P_{50})	Median Post (P_{50})	Sign Changes* +	o	-	Wilcoxon T	z	Sig.**
1. Repeating Own Questions	3.25	1.92	14	11	49	577.0	2.95	(.002)
2. Answering Own Questions	1.10	0.30	38	26	10	240.0	3.57	(1001)
3. Repeating Student Answers	6.80	2.50	12	3	59	385.0	5.12	(.0001)
4. Redirection	13.70	14.00	32	4	28	1183.0	0.35	(ns)
5. Prompting	1.67	1.80	30	13	31	875.5	0.47	(ns)
6. Clarification	4.20	5.36	33	13	28	693.5	1.81	(.05)
7. Percent Higher Cognitive Questions	59.75	76.50	55	2	15	483.5	4.66	(.0001)
8. Fact Questions	6.62	3.10	55	3	16	455.0	4.71	(.0001)
9. Comprehension Questions	4.80	4.80	29	9	36	888.5	1.21	(ns)
10. Analysis Questions	0.00	.50	23	30	21	436.5	0.68	(ns)
11. Evaluation Questions	3.70	3.70	29	4	31	1201.0	0.24	(ns)
12. Percent Teacher Talk	44.80	32.50	11	5	58	169.0	6.21	(.0001)
13. Average Length of Student Response	9.00	13.30	51	4	19	533.0	4.15	(.0001)
14. Total Number of Student Responses	29.33	27.00	24	0	50	911.5	2.56	(.005)
15. Percent Student Talk	32.50	48.17	54	3	17	452.0	4.73	(.0001)

* Ss=74

** p=one-tailed test

Blue

Yellow

Minicourse 8

Organizing the Kindergarten for Independent Learning and Small Group Instruction

Instructional Sequence 1

Objective: To develop teaching skills that establish the concept of working independently.

Teacher Behaviors:
- Discuss "working alone" with pupils using a story or example.
- Elicit examples of working alone from pupils.
- Explain role of teacher while pupils are working independently.

Instructional Sequence 2

Objective: To build teacher skills that lead to pupil skill in solving problems that occur during independent work periods.

Teacher Behaviors:
- Help pupils identify problems that might be met during completion of an assigned task.
- Seek from pupils and evaluate these alternate solutions.
- Set standards for what to do when finished with assigned activity.
- Evaluate pupil success at working alone.

Instructional Sequence 3

Objective: To develop teacher-learner expectations for delayed teacher response to pupil work.

Teacher Behaviors:
- Discuss with pupils the difference between immediate and delayed teacher response to pupil work.
- Demonstrate or use dramatic play to illustrate teacher response to pupil's work.
- Use nonverbal and verbal cues to help students adjust to delayed response.

Instructional Sequence 4

Objective: To combine independent work, problem-solving and delayed response into a learning environment using independent activity and small group instruction.

Teacher Behaviors:
- Discuss working alone with pupils.
- Present assigned task.
- Elicit problems and solutions from pupils.
- Set standards for what to do when finished.
- Provide delayed teacher response.
- Evaluate pupil's success at working independently.

Minicourse 8

MAIN FIELD TEST DATA

TEACHER BEHAVIOR

Behavior Compared	Median Pre (P_{50})	Median Post (P_{50})	Sign Changes* +	Sign Changes* 0	Sign Changes* -	Wilcoxon T	$\frac{T}{\sigma}$	Sig.**
1. Discuss Working Alone With Pupils	0.00	3.90	38	8	0	0	5.37	(.0001)
2. Explain Teacher Role While Pupil Works Independently	0.00	1.20	20	17	9	142	1.63	(.05)
3. Explain Teachers Delayed Resonse to Pupils	0.00	1.50	25	19	2	110	1.90	(.03)
4. Present Assigned Activity	4.25	6.00	31	4	11	325.5	1.97	(.02)
5. Help Pupil Identify Problems That Might Occur	0.00	4.38	38	4	4	79.5	4.65	(.0001)
6. Elicit Solutions From Pupil	0.00	3.30	32	7	7	103.5	4.00	(.0001)
7. Seek Alternative Solutions From Pupil	0.00	0.00	10	33	3	18.0	1.92	(.03)
8. What To Do When Finished	1.5	3.25	27	9	10	139.5	3.20	(.0007)

* n=46 Ss in sample

** p=one-tailed test

Minicourse 8

MAIN FIELD TEST DATA

STUDENT BEHAVIOR Behavior Compared	Median Pre (P_{50})	Median Post (P_{50})	Sign Changes* +	o	-	Wilcoxon T	z	Sig.**
1. Child Gives Examples of Working Alone	0.00	5.30	38	8	0	0.0	5.37	(.0001)
2. Child Describes Teacher Role	0.00	0.00	11	34	1	1.5	1.92	(.002)
3. Student Waited For Teacher--Delayed Response	0.00	0.50	22	24	0	0.0	4.11	(.0001)
4. Child Described Assigned Activity	0.00	2.33	26	10	10	140.5	3.03	(.001)
5. Pupils Identify Problems	0.00	1.88	30	12	4	40.0	4.40	(.0001)
6. Pupils Give Solutions	0.00	4.50	37	6	3	22.5	5.21	(.0001)
7. Pupils Give Alternate Solutions	0.00	0.00	10	33	3	18.0	1.92	(.05)
8. Pupils Go To Follow-up Tasks When Finished	0.00	1.10	26	19	1	17.0	4.13	(.0001)

* 46 Classrooms in sample

** p=one-tailed test

Green

Minicourse 5

Effective Tutoring in Elementary School Mathematics

Instructional Sequence 1

Objective: Practice Lesson and Introduction to the Basic Tutoring Sequence

Teacher Behaviors: Verbal praise
Prompting questions

Instructional Sequence 2

Objective: Diagnosis

Teacher Behaviors: Initial diagnostic question (e.g., "How did you get your answer?")
Number Operations: ask questions to test students' understanding of place value, regrouping, and renaming.
Verbal Reasoning Problems: ask student to read the problem and decide what number operation to use.

Instructional Sequence 3

Objective: Demonstration

Teacher Behaviors: Estimation
Number Operations: depending on the situation, use expanded notation, the number line, or concrete materials.
Verbal Reasoning Problems: have the student draw a picture of the problem and write a number sentence to express the problem's requirements.

Instructional Sequence 4

Objective: Evaluation and Practice, and Review of the Basic Tutoring Sequence

Teacher Behaviors: Assign an evaluation problem.
Assign practice problems.

Instructional Sequence 5

Objective: Organizing the Classroom for Increased Tutoring Time

Teacher Behaviors: Students correct their own work.
Students tutor each other (peer tutoring).

FREQUENCY MEASURES

I. Diagnostic Questions

1. Total of Diagnostic Subcategories

	N'	x	S.D.	t	p
Pre	43	11.4	5.78	4.43	.001
Post	43	16.4	6.04		

2. Subcategories

	Median Pre	Median Post	Sign Changes +	Sign Changes o	Sign Changes -	Wilcoxon T	z	Sig.
1. (N.O.) General Questions	2.5	4.0	26	4	13	71.7	1.93	.03
2. (N.O.) Questions about Place Value	0.5	1.0	16	16	11	111.5	1.85	.03
3. (V.P.) General Questions	2.0	2.0	24	4	16	363	.63	(ns)
4. (V.P.) Read the Problem	2.0	2.0	26	2	16	338.5	1.41	.08
5. (V.P.) Words you don't Understand?	0	1.0	35	5	4	71.65	4.30	.001
6. (V.P.) What number operation?	0.5	1.0	24	10	10	61.1	2.49	.005

Green

Green

II. TIME MEASURES--DEMONSTRATION TECHNIQUES

Number Operations: Amount of time (in seconds) teacher uses either Estimation, Expanded Notation, Number Line, or Manipulative Materials.

\+ 25

\- 11

o 7 (no change)

N'	T	-z	p	Median Pre	Median Post
43	170.5	2.55	.005	0	115 sec.

Verbal Problems: Amount of time (in seconds) teacher uses either Estimation, Manipulative Materials, Picute of the Problem, or Number Sentence to express the problem.

\+ 34

\- 10

o 0 (no change)

N'	T	-z	p	Median Pre	Median Post
44	216.5	3.25	.0005	42 sec.	150 sec.

Orange

Minicourse 2

Skills for Teaching the Kindergarten Child with Minimal Language Experience

Instructional Sequence 1

Objective: To develop teacher skills useful for extending the language and thought of kindergarten children.

Teacher Behaviors: Extend the phrase to a sentence.
Refine meaning by providing a word that more accurately describes the object or situation.

Instructional Sequence 2

Objective: To develop teaching skills that introduce and provide practice in the use of new language patterns.

Teacher Behaviors: Model a language pattern in context and if possible in conjunction with objects.
Elicit the language pattern from the pupils.
Praise in specific terms omitting personal element.

Instructional Sequence 3

Objective: To develop teaching skills that facilitate the meaning associated with the learning and use of positional words.

Teacher Behaviors: Model specific positional words in context and in conjunction with concrete objects.
Provide varied physical experiences to assure pupil comprehension of positional words.
Elicit positional words from the pupils.

Instructional Sequence 4

Objective: To develop teaching skills which increase children's abiltiy to describe and classify objects.

Teacher Behaviors: Elicit observations of objects.
Elicit observations of similarities and differences between and within groups of objects.
Provide linguistic structure for describing comparisons.

Instructional Sequence 5

Objective: To develop teaching skills that increase children's ability to identify and describe action.

Orange

Teacher Behaviors: Verbalize a motor activity in conjunction with a demonstration.
Model several verbs that identify action.
Elicit the use of modeled verbs from the children.

Minicourse 2

MAIN FIELD TEST DATA

INSTRUCTIONAL SEQUENCE 1

Behavior Compared	Median Pre (P_{50})	Median Post (P_{50})	Sign Changes* +	o	-	Wilcoxon T	$\bar{z}$	Sig.**
1. Teacher Introduces Specific Positional Words in Context and in Conjunction With The Objects	1.80	4.17	25	5	10	129.0	3.04	(.0001)
2. Teacher Models a Positional Word But Does Not Demonstrate The Position Meaning	2.50	5.00	27	4	9	172.5	2.52	(.006)
3. Providing Varied Physical Experiences To Help Positional Concepts	11.00	13.50	20	1	19	453.5	0.89	(ns)
4. Praise	19.50	21.50	25	0	15	337.0	0.98	(ns)

* 40 Ss in sample

** p=one-tailed test

Minicourse 2

MAIN FIELD TEST DATA

INSTRUCTIONAL SEQUENCE 2

Behavior Compared	Median Pre (P_{50})	Median Post (P_{50})	Sign* Changes +	o	-	Wilcoxon T	$\frac{T}{\sigma}$	Sig.**
1. Teacher Elicits A General Observation of Ungrouped Objects	0.00	0.00	17	25	2	125.0	2.70	(.004)
2. Teacher Elicits A Specific Observation of Ungrouped Objects	0.00	0.00	12	22	10	117.00	0.31	(ns)
3. Teachers Asks Children to Put Objects into Groups	0.00	3.50	24	6	14	244.00	1.84	(.03)
4. Teacher Makes a Group	0.00	0.00	15	20	9	110.50	1.13	(ns)
5. Teacher Elicits a General Explanation of Either Child-or Teacher-Made Group	2.50	10.00	30	6	8	113.50	3.73	(.0001)
6. Teacher Elicits an Observation of Similarities	3.83	8.50	27	3	14	280.0	1.94	(.03)
7. Teacher Provides Linguistic Structure for Describing a Comparison; Child Does Not Repeat	.67	4.33	36	0	8	119.50	4.49	(.0001)
8. Teacher Provides Linguistic Structure for Describing a Comparison; Child Repeats	0.00	0.00	15	19	10	132.00	0.82	(ns)
9. Teacher Refines Meaning By Providing a More Accurate Word	0.00	2.00	25	13	6	102.50	2.85	(.002)

* 44 Ss in sample

** p=one-tailed test

Orange